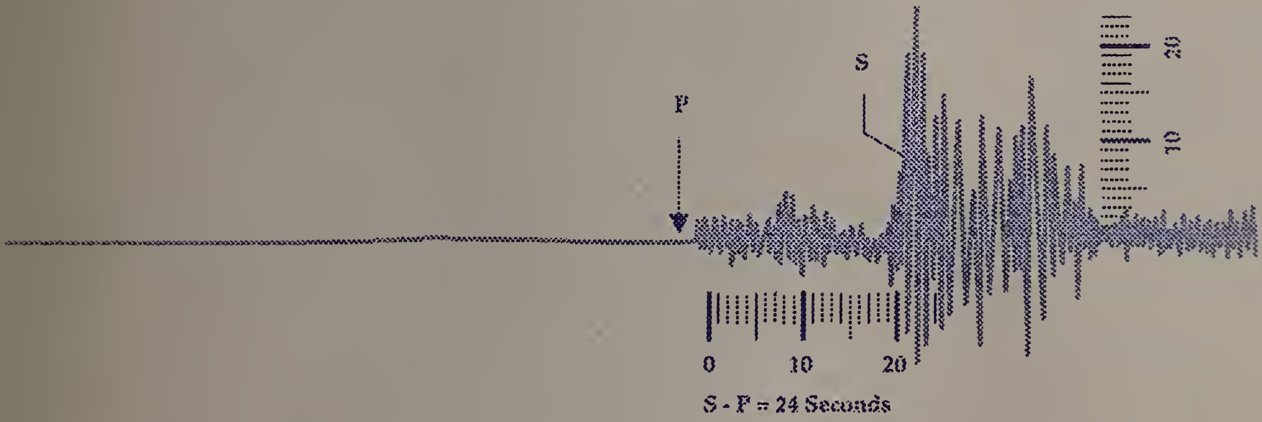
EARTHQUAKE SAFETY PROGRAMS

San Francisco Department of City Planning
September 1993



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Community Safety Element
of the San Francisco Master Plan
BACKGROUND REPORT 2

EARTHQUAKE SAFETY PROGRAMS

September 1993

San Francisco Department of City Planning

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INTRODUCTION

This is the second of two background reports that have been prepared to provide information to the City Planning Commission and the public as they consider amendments to the Community Safety Element of the San Francisco Master Plan. The first background report, *Review of Seismic Information*, described the earthquake risks faced by San Francisco as a result of its geology, soils, and structures. This second report describes the public and private programs that have been developed to lessen and respond to those risks, focusing on programs of the City and County of San Francisco. Safety issues are very diverse, and are sometimes dealt with by agencies that do not often work together. This report is intended for agencies with a responsibility for safety, and for members of the public concerned about safety issues, to help them identify and understand the programs that now exist. It will help them to identify gaps between current programs as well.

Programs to increase safety and decrease threats to life and property as a result of earthquakes have been classified into three general categories, described in the first three chapters of this report. The boundaries between these categories, however, are sometimes indistinct and some programs with broader goals could reasonably be put into more than one of these categories. The three categories are:

1. *Hazard Mitigation.* Hazard mitigation programs are intended to permanently reduce or eliminate long term risks. Hazard mitigation activities, effectively carried out, reduce the need for response and recovery from disasters because they will reduce the amount of physical damage suffered.

2. *Preparedness and Response.* Preparedness programs are those that educate and organize people to respond appropriately to disasters. They include education and awareness programs for individuals, families, institutions, businesses, government agencies and other organizations. Response programs include the plans of those with the primary responsibility for providing emergency and other services: the Fire Department, providers of necessary support services, etc.

3. *Recovery and Reconstruction.* After a major disaster, public and private decisions must be made about short-term and long-term rebuilding, the provision of housing for those displaced, resumption of services to homes and businesses, resumption of business and government functions. Funding issues are most likely to be critical.

A fourth chapter describes some programs which have a broader focus and which carry out activities that fall in more than one of these three categories. The fifth chapter describes the current Community Safety Element and identifies the programs that implement it, the ways that it has influenced City actions, and the areas in which implementation has fallen short.

This report concentrates on programs of the City and County of San Francisco because our goal is to explore ways in which the City and County can improve its efforts. These efforts take place in the context of activities by other levels of government and the private sector, whose efforts are described here when they have substantial impacts on the safety of people in San Francisco. The experiences and policies of other local jurisdictions are also explored where they have been different from San Francisco's and when they have addressed issues differently than San Francisco. Several other communities are also updating their Safety Elements (perhaps the recent increase in seismic activity has inspired this increased activity), and some have developed new ideas that are worth examining.

The California Seismic Safety Commission gives considerable thought to State-wide seismic safety programs, including local programs. It identified specific "Initiatives" in its report *California at Risk, Reducing Earthquake Hazards 1992-1996,*[1] which it believes should be pursued. Where those initiatives most closely relate to San Francisco issues, and where they call for local action, they are described here.

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[1] California Seismic Safety Commission, *California at Risk, Reducing Earthquake Hazards 1992-1996,* Report No SSC 91-08. December 1, 1991.

The Safety Element is being revised at the same time that the City's Emergency Operations Plan is being updated. That Plan specifically addresses the problems of immediate response to threats to life and property as a result of a disaster, and the resumption of services. The Safety Element is more suitable for addressing longer-term issues of mitigation, preparedness, economic recovery and rebuilding. Consequently, while emergency response programs are described in this report, it is not with a great deal of detail. In all cases, we have tried to document sources of information so that the interested reader can learn more about the programs described in this report.

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I. HAZARD MITIGATION

A. Reducing Hazards in New Structures

Model Building Codes

The regulations which govern the construction of buildings are contained in building codes. Model building codes are developed by private, non-profit organizations made up of local building officials which solicit the opinions of engineers, architects, building officials, contractors, materials suppliers, and others with an interest in construction practices. These codes are then adopted, sometimes with modifications, by state and local governments. The State of California requires the use of the Uniform Building Code (UBC) prepared by the International Conference of Building Officials (ICBO). The UBC's seismic safety provisions are developed by the Structural Engineers Association of California. Buildings built to these provisions are expected to resist damage from minor earthquakes, experience some non-structural damage from moderate earthquakes, and incur non-structural and some structural damage (but not collapse) from major earthquakes.

The UBC is updated on a three-year cycle by the ICBO, using a process which allows anyone, including private design and construction professionals, local and state officials, ICBO committees, and other interested parties, to propose amendments which are then considered by the ICBO membership of local building officials. Adopted amendments become part of the code.

The UBC is updated as knowledge about how structures respond to earthquakes grows. The first notable example of this is the code changes that followed the 1933 Long Beach earthquake. Unfortunately, the major way that the state of the art is advanced is by observing structures which fail during actual earthquakes. The 1971 San Fernando earthquake unexpectedly destroyed some recently built freeways and buildings. The most far-reaching building code amendments increasing buildings' structural resistance to earthquakes occurred after the 1971 earthquake, as engineers examined buildings that had failed.

Local governments are permitted to impose more restrictive standards than those in the model codes when this can be justified by local conditions such as seismicity, topography (for example hilly terrain), or climate. San Francisco adopts the UBC with some modifications which concern the resistance to ground-shaking, and hillside construction. The San Francisco Building Code establishes a Code Advisory Committee of design professionals, contractors, and other interested parties. The Committee is appointed by the Director of the Department of Public Works to advise the City on Code issues.

The San Francisco Building Code and review of new buildings.

The San Francisco Building Code is adopted by the Board of Supervisors and implemented by the Bureau of Building Inspection (BBI). BBI reviews and approves building plans, and inspects buildings under construction to insure that the approved plans are followed.

The current San Francisco Building Code requires new buildings to be constructed with earthquake resistant design and materials. It is intended to insure that buildings that conform to its minimum standards will not collapse in an earthquake of magnitude 7 to 8 on the Richter Scale. They may, however, suffer substantial and perhaps irreparable structural and non-structural damage.

Building codes consider soil conditions only at a very general scale. The 1906 and 1989 earthquakes demonstrated that soils conditions vary enormously throughout the city, and that different soils conditions can result in very different earthquake impacts. (See Background Report #1, *Review of Seismic Information* for more detail about the relationship between site conditions and earthquake damage.) Because of the importance of soil conditions, BBI requires and reviews geotechnical reports for projects on sites in areas with greater susceptibility to ground shaking and ground failure, and requires the design of foundations and structural systems which are more likely to survive these hazards. BBI is also planning to hire a licensed geotechnical engineer to review required geotechnical reports and structural plans in these more hazardous areas. This somewhat informal way of taking soil conditions into account in the building permit process will be formalized pursuant to the new Seismic Hazards Mapping program being undertaken by the State of California. That program is described below.

Alquist-Priolo Special Studies Zones Act of 1972.[2]

In 1972 (shortly after the 1971 San Fernando earthquake) the Alquist-Priolo Special Studies Zones Act established a program to identify active faults in California and prevent the construction of buildings across active fault traces. The California Division of Mines and Geology (CDMG) produces maps identifying Earthquake Fault Zones: areas within which active fault traces are considered likely to exist. (The name of this act was recently changed, and the term "Earthquake Fault Zones" replaced "Special Studies Zones" to avoid confusion with the "Seismic Hazards Studies Zones" described below.) Within these zones, local governments must require and review geologic reports for any proposed development. These reports show the more precise locations of the fault and its relationship to the proposed development. No substantial development can occur within fifty feet of the fault. Property owners must inform prospective purchasers of the property about the potential hazard.

Earthquake Fault Zones maps are not intended to provide all of the information about fault rupture hazards needed to decide the appropriate use of a site. Instead, they identify the areas in which it is reasonable to expect that a substantial fault rupture hazard may exist. The required site-specific geotechnical investigation is intended to provide both the owner and the local government with the necessary information to make development decisions.

There are no active faults within San Francisco, so there are no Alquist-Priolo Earthquake Fault Zones. Thirty-three of the 58 California counties have Earthquake Fault Zones, including Alameda, Contra Costa, San Mateo, and Marin Counties. The county with the largest number of proposed development projects within its Earthquake Fault Zones is Los Angeles County, with about 620 projects.

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[2] California Department of Conservation, Division of Mines and Geology, *A Study of the Effectiveness of the Alquist-Priolo Program*, 1991. DMG Open-File Report 90-18.

Seismic Hazards Mapping Act of 1990.[3]

The Alquist-Priolo Program deals only with the hazards posed by fault rupture. As described in Background Report 1, *Review of Seismic Information* fault rupture represents only a very small portion of the total earthquake risk. In 1990 the California Legislature enacted the Seismic Hazards Mapping Act (Chapter 1168, Statutes of 1990). This Act expands the concept of the Alquist-Priolo program to a number of other earthquake hazards. Under the terms of the Act, the California Division of Mines and Geology (CDMG) will map Seismic Hazards Studies Zones (SHSZs). These will include maps of areas which may be subject to amplified ground shaking, liquefaction and landsliding.

Implementation of the Act is currently being funded with revenues from building permit fees collected by local government.

CDMG has begun work on the San Francisco maps, and expects to have preliminary maps ready for local review in 1993.[4] CDMG staff are consulting with City staff in order to make the maps as complete, current, and useful as possible. There will be a 90-day period for public review of the preliminary maps. Public comments and recommendations will be received, and a public hearing held by CDMG. After considering public comments, the State Geologist will issue official maps. These maps will be posted with the Recorder, the Assessor and the City Planning Commission.

Within the SHSZs, whenever a development project is proposed, the proponent will be required to conduct a site investigation and prepare a geotechnical report to evaluate the nature and severity of the hazard, and to suggest appropriate mitigation measures. The City will review the report. The regulations include specific standards for the preparation, content, and review of the geotechnical reports, and provide for waiving the site investigation requirement when there is evidence, from nearby studies, that public safety is adequately protected. When approving any project in a SHSZ, the City will need to use the information and recommendations included in the report to achieve a reasonable protection of the public safety.

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[3] Real, Charles, and R.J. Holden, "Special Study Zones: A Viable Approach to Zonation for Ground Shaking Hazards," in *Proceedings of the Fourth International Conference on Seismic Zonation,* Earthquake Engineering Research Institute, 1991.

[4] Charles Real, Senior Seismologist, California Department of Conservation, Division of Mines and Geology, Telephone Conversation August 1993.

The City must also take the information contained in the maps into account when preparing the Safety Element, or when adopting or revising land use planning and permitting ordinances. After the final maps are issued, the Safety Element will be reviewed in light of any new information contained in the official maps, and revisions made as appropriate.

Real estate sellers must also disclose to any perspective purchaser the fact that the property is located within a SHSZ.

Field Act.[5]

After the 1933 Long Beach earthquake, the California Legislature passed the Field Act, which mandates seismic resistance in the design and construction of public primary and secondary schools and community colleges operated by local districts. The Field Act, and subsequent laws which broadened and strengthened its provisions, and applied them retroactively, is implemented by the Division of the State Architect, Office of Regulation Services. The ORS reviews plans for new schools and alterations for existing schools. It also inspects construction work done on schools. The Act was revised in 1959 and again in 1976 based on new information gained from observing the damage that occurred during earthquakes.

The Field Act addresses only structural safety in local public schools and community colleges. It does not address the issue of non-structural hazards in public schools. It does not apply to private schools, or to State colleges and universities.

Hospital Safety Legislation.[6]

A newly-constructed hospital was seriously damaged in the 1971 San Fernando earthquake, resulting in four deaths and making the hospital non-functional in the post-disaster period. Since 1973, public, private and state hospitals with state licenses have been subject to standards intended to assure that the facility not only survives an earthquake without collapse, but will be able to continue to function. (This is a considerably higher standard than the Uniform

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[5] Dennis Bellet, S.E., Division of the State Architect, Office of Regulation Services, February 25 1992 Telephone conversation.

[6] William Staehlin, Office of Statewide Health Planning and Development, 2/25/92 phone conversation.

Building Code.) The most recent legislation is the Alfred E. Alquist Hospital Facilities Seismic Safety Act of 1983 (Health and Safety Code Division 12.5). These laws are implemented by the Office of Statewide Health Planning and Development, which reviews plans and continuously inspects construction work at hospitals. These laws govern the construction of new state-licensed hospitals and alterations to existing hospitals. They do not apply to existing hospitals. Many San Francisco hospitals were built before 1973, and may be subject to structural failure or a loss of function after an earthquake.

The Office of Statewide Health Planning and Development also, in its Emergency Response Plan, sets standards for and oversees the post-disaster inspection of hospital facilities to determine if they can be occupied.

B. Reducing Hazards in Existing Facilities

Because many of San Francisco's buildings were built before building codes and construction practices reflected a knowledge about earthquake resistance, reducing earthquake impacts requires examining existing buildings and considering the best way to reduce their hazards. San Francisco has programs currently underway and others under consideration to reduce these hazards, in both City-owned and privately owned buildings.

Retrofit requirements triggered by remodeling and voluntary retrofits.

Buildings are generally required to meet the building code standards in effect when they were built, even if those standards do not result in the same level of safety that the current code provides. Under some circumstances, buildings are required to be retrofitted to higher standards than those in effect when they were built. This most commonly occurs when a property owner undertakes remodeling or other alteration which would change the building's use, a change of occupancy (capacity) or structural loading, or would substantially extend the building's life, as defined in Section 104(f) and Section 2313 of the San Francisco Building Code. In these cases the building must be structurally strengthened to meet the lateral force resistance requirements of the 1973 Uniform Building Code for new buildings.

Some building owners, out of concerns for safety and for the ability of their buildings to survive earthquakes, or because of concerns about liability or insurance issues, choose to voluntarily retrofit their buildings. Section 104 of the San Francisco Building Code provides standards and guidance to these owners.

Parapet Ordinance.[7]

Private property owners, even with no remodeling plans, are required to reinforce older parapets and other roofline appendages. Parapets (portions of walls extending above roof level), cornices (continuous horizontal projections from a wall, usually near the roof level), and other ornament that is not securely anchored to the building pose a high life safety threat during earthquakes. They readily shake loose, falling through roofs of adjacent buildings or on street level passersby. This problem is most common on unreinforced masonry and concrete buildings built prior to 1949. In 1969 the City enacted an ordinance that requires owners to strengthen these elements so that they will be less likely to fail. Other non-structural items that are inspected and corrected under this program include balconies, chimneys, overhangs, railings, roof-mounted equipment, statuary, stacks, tanks and roofline decorations. Compliance with the parapet ordinance is virtually complete in the Downtown, Chinatown, the Tenderloin, and the Bush-Sutter and Van Ness Avenue corridors, and the South of Market area. Inspections are now being conducted in the outlying areas of the City. The parapet safety program requirements are expected to be completed throughout the City by 1997 at the latest. About 5,100 parapet inspections have been made. Over 3,500 buildings have been brought into compliance.[8] Structural engineers have credited the strengthening performed pursuant to the parapet ordinance with preventing injuries and building damage which might otherwise have occurred during the Loma Prieta Earthquake.

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[7] John Greene, Parapet Inspector, Bureau of Building Inspection, 2/27/92 phone conversation.

[8] Parapet Safety Section, Bureau of Building Inspection, July 1993 Monthly Report.

San Francisco Earthquake Safety Program.[9]

General Fund Departments of the City own over 600 buildings. The average age of these buildings is over 50 years. They have an estimated replacement value of over $4 billion. Because of their age it is likely that many of them are susceptible to damage in earthquakes. The City has undertaken an inspection program to identify hazardous City-owned buildings. Two hundred and two buildings have been inspected, including those expected to be most vulnerable or which contain critical functions. They were rated on a scale ranging from 1 (minor damage), 2 (moderate damage), 3 (major damage) to 4 (collapse potential). Those rated 3 and 4 are most likely to pose a life safety hazard.

Thirty-two of these 202 buildings were rated 4 (collapse potential), including 10 Fire Department facilities (seven of which are active fire stations). Eighty-five are rated 3 (major damage), including many of the Civic Center administrative buildings, public assembly spaces and museums, branch libraries, police and hospital buildings, and fire stations.

The City has undertaken a program to improve the safety of City owned buildings. The three major goals of this effort are:

- to reduce life-safety risks in City owned facilities.
- to assure the continuity of essential services in the event of a seismic disaster.
- to protect the public investment in City buildings.

Smaller projects are funded and carried out as part of the annual capital improvement expenditures in the General Fund. Major capital improvements are largely funded by general obligation bonds which are approved by the voters. The Police Bond Measure of 1987 ($28 million) funded improvements, including seismic upgrading, to police facilities. The Library Bond Measure of 1988 funded seismic upgrading of some branch libraries. A 1989 bond measure ($60 million) funded the Earthquake Safety Program Phase I, which includes seismic and related disabled access and asbestos remediation work at 24 facilities including 19 fire stations, four public assembly buildings and a building at Laguna Honda Hospital. A 1990 bond measure ($332 million) funded the Earthquake Safety Program Phase II which includes 1.) repairs of earthquake damage from the Loma Prieta earthquake, and 2.) seismic strengthening of 20 buildings, and related disabled access and asbestos remediation work, including many in Civic

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[9] San Francisco Department of Public Works, *Proposal for Earthquake Safety Program for City-owned Buildings, Phase I,* May 1989, and *Proposal for Earthquake Safety Program for City-owned Buildings, Phase II,* January 1990.

Center. The Phase I and Phase II bonds also fund continuing structural assessment of the remaining City-owned buildings. Federal and State grants are also sought and used to retrofit vulnerable City-owned buildings.

The Earthquake Safety Program work has been prioritized, with higher priority assigned to:

- facilities containing critical functions
- unreinforced masonry buildings
- high occupancy buildings
- those with an ornate, monumental style of architecture which will be difficult to repair or replace when damaged
- the severity of the seismic hazards.

Planning, programming and design work is underway for 44 of these buildings. Earthquake strengthening is complete on three of these buildings and construction has begun on five others.[10]

Unreinforced Masonry Building Hazard Reduction Program.

Unreinforced masonry buildings (UMBs) are known to be hazardous in earthquakes. The risks posed by UMBs in San Francisco are described in more detail in Background Report #1. In 1986 the California Legislature enacted the Unreinforced Masonry Law (Government Code Section 8875). This act requires cities and counties in Seismic Zone 4 to inventory UMBs, to notify owners that their buildings are potentially hazardous, and to develop programs to mitigate this hazard.

The Bureau of Building Inspection prepared an inventory of San Francisco UMBs in 1988. It showed that there were about 2,000 of these buildings. The Chief Administrative Officer (CAO) convened a Task Force and a Citizens Advisory Committee consisting of owners, tenants, and others with an interest in the subject.

A number of important policy issues were raised in the course of considering policy options for reducing the UMB hazard. As discussed in Background Report #1, many UMBs contain low-income housing and small businesses, uses which could not support higher rents resulting from seismic retrofit. Many UMBs are older buildings of architectural or historic interest.

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[10] George White, Program Manager, Office of Capital Resource Management, September 1 1993 personal communication.

In July 1992 the Board of Supervisors passed, and the Mayor signed, legislation establishing a program to reduce hazards in unreinforced masonry buildings. It amends the Building Code and other City codes to set standards for the retrofit of UMBs and establish procedures to be followed by building owners and City agencies. It sets a deadlines for the work, based on the location and use of the building, which range up to thirteen years. In November 1992 San Francisco voters passed a $350 million bond issue to establish a loan fund to assist owners to carry out the work. The Board established a Program Board which includes representatives of owners and tenants of commercial and residential UMBs and of other interested groups. The Program Board is currently developing regulations for the administration of the Seismic Safety Retrofit Bond Program.

Reducing Hazards in Public Schools and Hospitals.

Because of the Field Act (described above), public schools in San Francisco are probably less susceptible to collapse and disabling damage than other buildings. However, "Early Field Act schools," those built under the provisions of the Act, but before the engineering lessons of the 1970s were integrated into the requirements, may sustain significant loss of function, and may cause injuries to students and teachers during an earthquake.[11]

The San Francisco Unified School District has undertaken seismic retrofit programs where its facilities planning staff found it necessary, largely as a result of damage suffered during the 1989 earthquake. The District is not currently evaluating all school buildings for conformance to current codes.[12]

The Division of the State Architect has begun to review its data to develop a list of pre-1976 public school buildings. The Division hopes, when funding is available, to assemble an inventory of these buildings and identify those needing further seismic hazard evaluations.[13] This inventory is identified as a Milestone by the California Seismic Safety Commission, in *California at Risk, Reducing Earthquake Hazards 1992-1996.*[14] That plan established the following goal: "By January 2000, all school districts identify and reduce unacceptable earthquake hazards in public schools." The SSC recommended that State legislation be developed to require local school districts to address the issue of seismic safety in early Field Act schools. The SSC estimated that, statewide, structural evaluations will cost about $3 to $5 million, and that seismic retrofits will cost about $2 to $5 billion.

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[11] Fred Turner of the Seismic Safety Commission estimated that on the order of 1% of the State's 30,000 public schools could be significantly damaged in a large earthquake.

[12] Joyce Oishi, San Francisco Unified School District, Facilities Planning Office, Telephone conversation, August 12, 1993. Telephone conversation, August 19, 1993.

One local school district, the Berkeley Unified School District, has assessed the seismic vulnerability of its school buildings. In response to the survey, Berkeley voters approved a $158 million bond issue for seismic retrofitting and other improvements in the schools. Additional funds were received from state school bonds. Three schools were closed as a result of the survey.[15]

City-owned hospital buildings are included in the San Francisco Earthquake Safety Program, described above. It found that nine subsidiary buildings at the Laguna Honda Hospital complex and 18 at the San Francisco General Hospital complex are vulnerable to severe earthquake damage. Funding has been secured for seismic retrofit of two of these buildings.

California at Risk[16] also included a goal addressing older hospital buildings: "By December 1996, the Seismic Safety Commission and the Office of Statewide Health Planning and Development establishes an earthquake hazard mitigation program to improve the seismic performance of pre-Hospital Act facilities housing acute-care services to ensure their availability following earthquakes." The Commission estimated that, statewide, achieving this goal will cost over $8 billion. Due to a lack of staff, the SSC is not currently working on developing such a program.[17]

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[13] Dennis Bellet, S.E., Division of the State Architect, Office of Regulation Services, 8/18/93 telephone conversation.

[14] Initiative 1.3, California Seismic Safety Commission, *California at Risk, Reducing Earthquake Hazards, 1992-1996,* Report No. SSC 91-08, December 31, 1991.

[15] Anton Jungherr, Associate Superintendent for Business, Berkeley Unified School District. August 30, 1993, Telephone Conversation.

[16] Initiative 1.2, California Seismic Safety Commission, *California at Risk, Reducing Earthquake Hazards, 1992-1996,* Report No. SSC 91-08, December 31, 1991.

Hazard Mitigation Plan and Hazard Mitigation Grant Program.

The Federal disaster assistance program, under the 1988 Stafford Act, (44 CFR 206.400), requires that jurisdictions applying for post-disaster assistance prepare a *Hazard Mitigation Plan* which describes local efforts to mitigate earthquake hazards. San Francisco's *Hazard Mitigation Plan* was prepared by an inter-departmental committee coordinated by the Chief Administrative Officer. It was adopted by the Board of Supervisors in March 1990 and approved by the State Office of Emergency Services in April 1990. The *Plan* has four parts: 1. an evaluation of the earthquake hazard in San Francisco; 2. current hazard mitigation policies, programs and capabilities; 3. proposed hazard mitigation strategies, programs and actions; 4. a plan for implementation, monitoring, evaluating and updating the *Hazard Mitigation Plan.* The focus of the *Hazard Mitigation Plan* is actions which could be taken by City agencies, using Hazard Mitigation Grants, to strengthen public facilities, especially those critical to emergency response. The Plan identified projects which should be undertaken, but were not then finally designed, approved, and/or funded.

After the preparation of the *Hazard Mitigation Plan,* the City applied for Hazard Mitigation Grants (which are matching grants requiring local funding). Federal disaster recovery law permits states to use 10% of the funds devoted to public assistance to hazard mitigation. The City's application was for some of the projects described in section 3 of the Plan, totalling $18 million in grant requests (an additional $18 million would be provided as a local match). Eight projects, totalling $6.5 million in grant funding, have been approved by the State OES since 1991. Most of these projects are underway, including retrofits of several Fire Stations, the retrofit of the boiler plant at San Francisco General Hospital, seismic upgrades at San Francisco General and Laguna Honda Hospitals, and the purchase of generators for the Fire Department. In 1993 an updated application will be submitted, for projects totalling $2.5 million.

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[17] Fred Turner, Seismic Safety Commission, telephone conversation August 19, 1993.

Earthquake Safety and Public Buildings Rehabilitation Bond Act of 1990

In 1990 the voters of California approved $300 million in general obligation bonds for the reconstruction, repair, replacement, relocation or retrofitting of seismically deficient state and local government buildings. $50 million was set aside for local government essential services, emergency and public safety buildings. Priority is given to projects in the most seismically active parts of California, which includes San Francisco. Local governments must provide at least 25% of the cost.[18] San Francisco, through the Chief Administrative Officer, has applied for funding for 14 projects with total costs of about $15.7 million. They include 11 Fire Department facilities, one Police Department facility, and two jail buildings in San Bruno.[19]

Caltrans seismic retrofitting activities[20]

Some of the most serious, as well as some of the most visible, damage from the Loma Prieta earthquake was suffered by bridges and other transportation structures operated by CalTrans. These bridges and viaducts remain quite vulnerable to collapse during an earthquake. Caltrans is currently undertaking the retrofit of the state's single and multiple-column bridges and major toll bridges that are most vulnerable to earthquakes, critical to emergency response capabilities, and/or critical to the state's economy. By the end of 1993, Caltrans plans to complete design work and award contracts for the retrofit of the most vulnerable single- and multiple-column bridges. By the end of 1994, Caltrans plans to complete design work and award contracts for the retrofit of major toll bridges.[21]

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[18] State of California, Office of the State Architect, *Local Government Handbook, Part 1, Prequalification, Earthquake Safety and Public Buildings Rehabilitation Bond Act of 1990*, January 15, 1993.

[19] John Sucich, Assistant to the Chief Administrative Officer, Personal communication, August 20, 1993.

[20] The Governor's Board of Inquiry on the 1989 Loma Prieta Earthquake, *Competing Against Time*, May 1990. California Office of Planning and Research.

[21] Initiative 1.16, California Seismic Safety Commission, *California At Risk*, Reducing Earthquake Hazards 1992-1996, Report SSC 91-08.

Lifelines

Because of its age and its underground location, the water system is vulnerable to damage from earthquakes. As described in Background Report #1, this has critical implications for firefighting as well as for serving the ongoing needs of San Franciscans.

The San Francisco Water Department is replacing weak, brittle cast iron water mains, installed between the 1850s and 1938, with new mains of ductile iron. Ductile iron is more resistant to earthquake forces. Priority is being given to the replacement of mains in areas with poor soils. 35,000 linear feet are replaced each year. However, because there are about 1000 miles of cast iron pipe in the City, replacement will take many years.[22]

The Water Department also has an ongoing project of installing gate valves, which compartmentalize the system and shorten the length of pipeline taken out of service in the event of main breaks. These programs will help to maintain domestic water service after an earthquake, and will, over time, reduce the number of fire hydrants out of service as a result of main breaks.

Pacific Gas and Electric Company conducted a study of the likely effects of earthquakes on its above-ground and underground facilities.[23] It found that the greatest vulnerability of the gas system was in areas of soft soils and older, brittle pipe. As a result, PG&E's 25-year Gas Pipeline Replacement Program has been modified to place higher priority on replacement of pipe within these vulnerable areas. It found that there will probably be damage to local electric distribution lines, which can be easily repaired. The most vulnerable parts of the electric system are substations. PG&E has an on-going program to replace and brace substation components. It has developed a plan to reduce disruptions to its Northern California gas and electric systems by the year 2000. This plan includes ongoing assessment of the hazards to the systems.

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[22] Tom Dickerman, Manager, City Distribution Division, San Francisco Water Department, Personal communication, August 18, 1993.

[23] Pacific Gas and Electric Company, *Program for Reducing Earthquake Vulnerability of Gas and Electric Systems by the Year 2000*, December 1990.

Potential programs that could influence mitigation

Because San Francisco is largely built out, the repair, rehabilitation, and retrofitting of existing buildings is one of the most effective ways of reducing the risk of injury and death from earthquakes. The U.S. Congress is currently considering legislation (H.R. 1406) that would provide for tax credits for these activities. Such legislation would encourage private owners to undertake projects that would increase public safety.

Non-structural mitigation

Most of the programs described in this chapter address the problem of hazardous structures. As discussed in *Report #1*, non-structural hazards also pose a substantial risk during earthquakes. This hazard is, in some ways, less amenable to legislative solutions. While architects and engineers design structures and building officials check their plans, the non-structural elements such as windows, equipment, computers, inventory, furnishings are placed by all of us. The most effective approach to the mitigation of non-structural hazards is raising public awareness through preparedness programs, such as those described in the next chapter. The Bay Area Regional Earthquake Project (Now the California OES Earthquake Program) has produced a booklet on mitigating non-structural damage in commercial buildings, *Reducing the Risks of Nonstructural Earthquake Damage: A Practical Guide,*[24] and developed hand-out materials on specific non-structural hazards. The U.S. Geological Survey's widely distributed *The Next Big Earthquake in the Bay Area may come sooner than you think* contains information for reducing non-structural damage in the home.

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[24] Bay Area Regional Earthquake Preparedness Project, *Reducing the Risks of Nonstructural Earthquake Damage: A Practical Guide.* Second Edition, 1985.

II. PREPAREDNESS AND RESPONSE

Response activities encompass the immediate actions taken to save lives, provide care for the injured, protect property, and provide for the basic needs for food, shelter and information in the wake of a disaster. Preparedness includes planning, education, and training for these actions. Each of these categories includes activities undertaken by emergency responders like fire-fighters and paramedics, other government agencies, community-based organizations, families, businesses and individuals.

A. The City and County of San Francisco Emergency Response

Planning for response to emergencies is largely the responsibility of local government. The first responders, and those with lead responsibility during the response phase of a major disaster are the same agencies that have a day-to-day responsibility for responding to emergencies: the Fire Department, Emergency Medical Service, the Police Department, the Department of Public Works. However, in a major disaster the needs for assistance are greater than the resources of the usual responders; in fact this could be said to be the definition of a major disaster. During and after a major disaster additional organizations, both City agencies and other organizations, will be called into service. Therefore, a significantly heightened level of coordination, and different type of organization is necessary.

The Emergency Operations Plan

The *Emergency Operations Plan* (EOP) sets forth the coordination requirements for the official response to a major disaster. The Mayor's Office of Emergency Services (OES) has the primary responsibility for coordinating the EOP while individual departments prepare individual plans. Departmental plans are included in the EOP as "Annexes" to the basic plan. The Office of Emergency Services and the Emergency Operations Plan are established and described in Chapter 7 of the San Francisco Administrative Code.

The current *Emergency Operations Plan* was completed in 1987. It follows federal guidelines which set the standards at that time and required a "Multi-Hazard Functional Plan." It is contained in two large volumes, and was never widely distributed or exercised. During the Loma Prieta earthquake it was perceived as unwieldy and ineffective. Consequently, it was not closely followed. The OES is undertaking a review and revision of the EOP, with the assistance of a task force of representatives from City departments and other organizations involved in response.

New California legislation passed in 1992 established the Standard Emergency Management System (SEMS). (This is often referred to as the Petris Bill.) This act bases post-disaster financial assistance on the adoption of an EOP which meets certain standards by 1994. The act was passed largely in response to the East Bay Hills fire, when there was a lack of coordination between response agencies and jurisdictions. It replaces the concept of the "Multi-hazard Functional Plan". EOPs will be required to use the Incident Command System (ICS) a standard system of organizing response which allows personnel of different jurisdictions and organizations to communicate effectively. The California Office of Emergency Services is developing regulations to implement the Act. Draft regulations will be issued in late 1993 for public comment. Staff from the California Office of Emergency Services are working with the City's EOP task force to assure that the City's new EOP will comply with the Act.

The EOP will describe the coordination and communication between city responders, other governmental agencies, non-governmental agencies involved in response (such as the Red Cross), and the public during a major disaster. Command and coordination functions will be housed in the Emergency Command Center, a new facility which has been built since the Loma Prieta earthquake. The ECC will house the policy-makers, and will serve as a communications hub to assure maximum coordination between the responding agencies. Other functions, such as establishing shelters, continuity of government, will be addressed.

The three-member staff of the San Francisco OES is coordinating the efforts of an inter-departmental task force preparing the City's EOP. A draft is expected in 1994. The draft plan will be considered for adoption by the Board of Supervisors.

Chapter 7 of the Administrative Code also creates a Disaster Council with responsibility "for the preparation and carrying out of plans for the protection of persons and property . . . in the event of an emergency." Its members include the Mayor, the CAO, "officers in charge of emergency services," three members of the Board of Supervisors, and others appointed by the Mayor. The Disaster Council has not been an active body, having no staff and no direct funding. Mayor Jordan restructured the Disaster Council in 1992, reducing it from 55 to fifteen members and a Response Advisory Group.

Most of the preparedness work that has been accomplished by City agencies has been done by staff whose direction has come through the departmental channels, rather than through the Disaster Council. Coordination has been achieved through inter-departmental staff communication at the direction of Departmental managers, rather that explicitly through the Disaster Council. For example, the April 1993 City-wide earthquake exercise was planned and executed by an inter-departmental task force coordinated by OES. Given the way in which City departments' responsibilities, work programs, and funding are determined, it seems inevitable that the Disaster Council will not play a lead policy and planning role in disaster preparedness for government agencies.

Departmental Plans

In efforts related to the EOP, many City Departments are reviewing and revising their departmental plans. City Departments have responsibilities for the safety of employees and facilities similar to those faced by any establishment.

The emergency responders described below have additional responsibilities during a disaster. They must continue to provide services, sometimes at higher levels than usual, sometimes with fewer resources than usual. The departmental emergency plans of these City agencies reflect these additional responsibilities. Several of these response agencies have recently updated, or are in the process of updating their departmental emergency plans in coordination with the City's EOP revision process.

The *Fire Department* is the "lead agency" during a major earthquake. This means that the City's EOP assigns a management role to the Fire Department. Fire Department staff direct most major response efforts. Because the Fire Department's disaster operations are so closely linked with the City EOP, it will be updated in close conjunction with the EOP.[25]

The Fire Department uses a decentralized operations system, the "Battalion Command System" during a disaster, or other time of heightened activity for the Department. Each of the ten existing battalions has a designated headquarters which serves as a communications center for the battalion, and a coordination point for personnel and resources at all of the fire stations within that area. (There are 41 fire stations in the City.) It will also serve as an area headquarters, as needed, for operations staff from other agencies including the Department of Public Works and the Emergency Medical Services, and Neighborhood Emergency Response Team (NERT) volunteers (see below).

The Fire Department operates a preparedness program designed to help people, on a team basis, to respond to disasters when the usual emergency responders are overwhelmed. The program, Neighborhood Emergency Response Teams (NERT), consists of five three-hour classes that cover disaster medicine, small fire extinguishment, search and rescue, damage assessment, utility control (when and how to shut off gas, water and electricity), and team operations. Classes are offered to neighborhood groups, city departments, and businesses. They are taught by fire-fighters. The program emphasizes the importance of neighbors working together and looking out for one another. About 1500 people in several neighborhoods have completed the training. 22 additional classes with about 1000 participants are scheduled through March 1994. Classes are conducted when Fire Department funding is available.

The *Department of Public Health*[26] (DPH) is updating its Departmental Emergency Response Plan (ERP). This plan establishes procedures and responsibilities for providing public health services (i.e., mental health services, control and remediation of toxics materials, etc.) and emergency medical care after a disaster. The DPH ERP addresses coordination within the department to facilitate disaster response activities. DPH staff hopes to establish a training program based on the updated plan to protect the health and safety of each DPH employee and continue critical services. DPH has one staff member assigned to emergency planning and coordination, assisted by a departmental Emergency Response Committee to facilitate plan development and revision.

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[25] Assistant Chief Dennis Callahan, San Francisco Fire Department, August 17, 1993 Telephone Conversation.

[26] Jorge Palafox, Department of Public Health, Emergency Medical Services, telephone conversation, August 11, 1993.

Each hospital, as part of its accreditation, creates and maintains its own emergency plan, as required by the Joint Commission on Accreditation of Hospital Organizations (JCAHO). On the local level, the EMS Agency maintains a working relationship with the hospitals to coordinate disaster planning activities. Following a disaster, the Agency is responsible for damage assessment, casualty tracking and distribution of EMS resources through direct radio communications with the hospitals. The EMS Agency hopes to computerize the system by the end of 1993.

The Office of Statewide Health Planning and Development (whose role in reviewing plans for hospital construction projects was described above) also has a response role, in coordination with the Department of Public Health and the hospitals. After an earthquake, the Office will dispatch "qualified staff to conduct rapid assessments of structural and critical nonstructural component damage in acute care hospitals, skilled nursing and intermediate care facilities." The inspection teams will be in communication with State health care planners via cellular telephones.[27]

The Department of Public Health is also part of the State of California's planning and response process for hazardous materials emergencies. The Chemical Emergency Planning and Response Commission is appointed by the Governor to coordinate the overall State response to emergencies involving hazardous materials. It includes representatives of state and local agencies. Regional committees, staffed by the State OES regional office, are appointed in each of the OES mutual aid regions. They include representative of state and local jurisdictions, environmental groups, industry, and other interested parties. These committees develop a response plan for the region, and coordinate local agencies. The San Francisco Department of Public Health is represented on this Local Emergency Planning Committee.[28]

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[27] Gary Pettigrew, Office of Statewide Health Planning and Development, Division of Facilities Developments, Letter of January 17, 1992 to the Laguna Honda Hospital Administrator.

[28] David Zocchetti, State Programs Manager, Hazardous Materials Division, California Office of Emergency Services. Telephone conversation August 30, 1993.

The *Department of Public Works,*[29] is in the process of revising its departmental operations plan, based on its experiences during the 1989 earthquake. The plan is divided into four functions:

* Structure use management, which includes inspecting buildings and assuring their safety.
* Street use and utility management, which includes maintaining service of streets and City-owned utilities.
* Waste disposal management, which includes sewerage and solid waste.
* Records and Resource management.

DPW preparedness/response planning emphasizes training. About 80 DPW staff members will receive NERT training this year (see Fire Department, above). In hopes of achieving quicker inspection of essential services, DPW is developing a program to train some facilities workers from the Fire Department, the Police Department, and the Department of Public Health in the rapid evaluation of structural damage. DPW has one full-time staff member assigned to emergency planning and coordination.

The San Francisco Water Department provides water for fire-fighting, as well as the domestic water supplies needed by homes and businesses. The Water Department contracted with EQE Engineering, an engineering and earthquake research firm, to prepare its departmental emergency plan.[30] The plan evaluates the system, its capabilities and vulnerabilities. It estimates the damage to the water system likely to result from a Maximum Credible Earthquake.[31] EQE and SFWD's in-house Emergency Planning Committee worked together to develop an Emergency Response Plan, to locate and repair those breaks as quickly as possible, using both department workers and pre-arranged contractors. The Department has established a departmental operations center. The Department's goal is to have all 12-inch and larger pipes back in service within 14 days. This would bring the water system back to a pre-disaster state (so that auxiliary fire-fighting systems would no longer be needed), except for restoration of domestic service in areas with breaks in the smaller, local pipes.

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[29] Suzanne Hart, Department of Public Works Emergency Planner, Telephone conversation August 12, 1993.

[30] Tom Dickerman, Manager, City Distribution Division, San Francisco Water Department, telephone conversation, August 11, 1993.

[31] A "Maximum Credible Earthquake" is the largest earthquake that scientists believe could occur at a given location. The Maximum Credible Earthquake in San Francisco is about the size of the 1906 earthquake.

A major disaster challenges all communications systems, including the 911 emergency lines. This seems obvious, however, little thought or planning has been given to disaster communications procedures, specialized equipments, or operators. Further, people may expect that 911 will provide a normal level of service during a major emergency. Several recent audits of the 911 system conducted by the Board of Supervisors, the Mayor's Office of Emergency Services, as well as work on this issue by the Police Department (which manages the system), indicate the system does not have sufficient capacity to operate effectively in a major emergency. The Mayor's 911 Implementing Committee, comprised of the relevant Department Heads, is in the process of organizing to address this issue, particularly the hardware, operator training, and management systems in the 911 Communications Center. This is likely to involve redesigning the existing computer system, site relocation, new construction, and human resources issues.[32]

The Public Utilities Commission *Bureau of Energy Conservation* is preparing a plan for potential future energy shortages, with funding from the California Energy Commission. This plan will examine the implications of an energy shortage resulting from external or international forces as well as a shortage resulting from a natural disaster. It will assess the likely impacts of a disaster on energy supplies, set priorities for distribution of available energy resources after a disaster, and make recommendations for procedures to be followed to allocate energy. The draft plan is expected to be completed in 1994. The plan will then be presented to the Board of Supervisors for adoption.

The California Education Code requires private schools and public school districts to establish an earthquake emergency procedure in every school building to include a building disaster plan, regular drills, and an education program.[33] *The San Francisco Unified School District* has recently completed a draft update of the current Emergency Operations Plan.[34] The revised draft is being submitted to the Superintendent for review. It provides for immediate school sites damage assessment to be conducted by District maintenance staff, with post earthquake inspections to be provided by licensed architects from the District's Facilities Planning staff. The Division of the State Architect, which implements the Field Act (described in Chapter 1) will also send inspectors to public schools after an earthquake. The District intends to keep children at school sites until they can be released to their parent or guardian. In 1987 the District created a two-way radio communications system, which includes hand-held portables that can connect schools and the District's emergency operations center. Work is currently underway to connect each school site and the District's emergency operations center using land-line telephones. The Districts's emergency operations center has a communications link with the City's EOC. The District is also considering using its radio station, KALW, to broadcast information to parents and the community as needed. KALW has generators and expects to be able to broadcast after an earthquake.

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[32] Carl Hedleston, Coordinator, Mayor's Office of Emergency Services, Personal communication, August 31, 1993.

[33] California Education Code, Article 10.5, Earthquake Emergency Procedures.

[34] Ray Favetti, Assistant to the Director of Building and Grounds, San Francisco Unified School District, telephone conversations, August 12, 1993 and August 17, 1993.

District staff is proposing a program of emergency response training for school site personnel, a program which has not currently been funded.

B. *State and Federal Efforts*

The State of California Office of Emergency Services has the responsibility of coordinating the state's preparedness and response activities. It also has some responsibility for mitigation and recovery, and provides technical assistance for local governments. The California OES is divided into three administrative regions; San Francisco is in the Coastal Region. While response agencies are local, the California OES plays a key role when local agencies run short of resources. During a disaster, local agencies request additional personnel, supplies or other resources through their "operational area" (usually a county). The request in conveyed to the California OES which monitors the State-wide resource situation and administers the state's mutual aid system, and communicates with federal agencies including the Federal Emergency Management Agency.

The Earthquake Program of the California OES, formerly called the Bay Area Earthquake Preparedness Project (BAREPP), promotes earthquake preparedness among local governments and other organizations including school districts, residential care facilities, non-profits organizations and businesses. It produces technical and non-technical publications about earthquake mitigation, preparedness and recovery for the public, businesses and local governments.

California has a Master Mutual Aid agreement of which all local jurisdictions, including San Francisco, are part. Mutual Aid is a concept, first developed by fire departments, whereby agencies agree in advance to come to each others' aid with personnel and equipment when one of them has exhausted its resources. Issues such as payment, insurance, responsibilities of both the requesting and responding agencies are set forth. The statewide nature of the program is important for regional disasters such as earthquakes. When San Francisco response agencies are overwhelmed, it is likely that its immediate neighbors will be in a similar situation. The State Master Mutual Aid system can bring in personnel, supplies, and equipment from unimpacted areas outside of the region, or from the federal government. The State Mutual Aid system is administered by the California Office of Emergency Services. The system began to serve fire/rescue and law enforcement agencies. It now (and increasingly) includes other services, including building inspectors, medical personnel, coroners, water departments, and others.

The federal agency with primary responsibility for preparedness and response, as well as a major responsibility for recovery, is the Federal Emergency Management Agency. FEMA becomes involved in disaster response only when requested by local governments through the state, and when a presidential declaration of emergency occurs. FEMA is responsible for coordinating the use of federal resources. It also influences the actions of state and local agencies because of its role in disbursing and monitoring federal financial assistance for the expenses incurred in responding to a disaster and rebuilding after one.

The U.S. Geological Survey conducts basic and applied research on earthquakes, volcanoes, and other topics within the earth sciences. Its focus has traditionally been on producing technical reports and studies. In recent years the USGS has become more concerned with communicating the results of its research to the public and to local decision-makers in order to encourage local preparedness efforts. The most ambitious product resulting from these efforts was a popular 24-page tabloid publication, *The Next Big Earthquake in the Bay Area May Come Sooner than You Think*, produced in cooperation with the American Red Cross and the United Way in 1990. Written in easily understood language, it was included in Sunday newspapers in the region and distributed widely. It was printed in English, Spanish, Chinese, Braille, and Recordings for the Blind. It was one of the most extensive efforts ever undertaken to educate the public about earthquake risks and preparedness.

C. *Private and Non-Profit Organizations*

Non-profit organizations, especially the American Red Cross, are very involved in the provision of basic human needs such as food and shelter immediately after a disaster. (This element of emergency response is closely related to recovery activities such as the provision of short-term housing, which are discussed in the next chapter of this report.)

The Red Cross's disaster responsibilities include providing mass care, food and shelter.[35] The San Francisco Administrative Code[36] gives the Red Cross the primary responsibility for providing post-disaster shelter to those displaced by a disaster, in cooperation with City agencies. This involves recruiting and training volunteers, setting up shelters in the locations designated in the City's EOP, setting up canteens as needed for victims and response workers. A county plan has been developed which establishes responsibilities and procedures for providing services, including coordination with public agencies. A 5-county Bay Area plan is also in the planning stages. The county plan will allow the Red Cross to coordinate resources throughout the region.

The Red Cross also provides individual assistance to victims of disasters and conducts community disaster education in the form of courses, publications and cooperative programs.

During 1990, the United Way, with the cooperation of the Red Cross, conducted a study, *The Greater Bay Area Community-Wide Disaster Response and Planning Project,*[37] to examine the relief and recovery service delivery after the 1989 earthquake and to develop recommendations for improving those services in future disasters. The project resulted in the establishment of the Northern California Disaster Preparedness Network, to promote community-based preparedness. The Network provides funding and guidance to local organizations involved in disseminating information about disasters and preparedness, training and planning for disasters, and post-disaster relief. It emphasizes the participation of community-based organizations working locally, particularly those which serve the populations at greatest risk. It is funded by donations received by the American Red Cross after the Loma Prieta earthquake.

The Red Cross sponsors annual *Bay Area Business, Government & Red Cross Disaster Conferences* to help businesses prepare for disasters. These conferences, produced with the help of local business people, include presentations on improving safety for workers and visitors, avoiding property damage, and minimizing business disruption through planning and cooperation.

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[35] James Aldrich, Manager of Disaster Services, American Red Cross, Golden Gate Chapter, August 13, 1993 telephone conversation.

[36] San Francisco Administrative Code, Section 7.9.

[37] The United Way, Arthur D. Little, Arthur Andersen & Co., Berkeley Planning Associates, Michael Doyle Associates, *Greater Bay Area Community-wide Disaster Response and Planning Project,* Phase I Report March 1991, Phase II Report August 1991, Phase III Report October 1991.

The Salvation Army's Central Kitchen at 850 Harrison Street is equipped to produce up to 30,000 meals in 24 hours, under emergency conditions. It is equipped with on-site generators and on-site food storage.[38]

The Salvation Army operates a preparedness program called San Francisco Program for Responsible Emergency Preparedness (SF PREP). Developed with assistance from the American Red Cross, SF PREP is intended to go beyond simple education and to motivate people to actually change their behavior to become more prepared for earthquakes. It does this by working with groups, to inspire group support for preparedness, by following up in order to keep awareness and enthusiasm high. The focus of the program has been on the elderly, at senior centers and senior housing facilities. The Salvation Army plans to expand it to churches and business groups soon.[39]

Several community-based organizations and neighborhood groups are working on increasing neighborhood-based preparedness and developing neighborhood-based response capabilities. The Chinatown community is one of the most active.[40] The NICOS Chinatown Disaster Response Steering Committee, which includes representatives of community-based organizations, was established in 1990. It has assessed the community-s disaster related needs and concerns, developed a neighborhood response plan, which it is currently reexamining. Three NERT groups, from community organizations, have been trained. The committee has been holding twice-yearly drills, to familiarize residents with safety issues and the plan, to exercise communications resources including amateur radio operators who are participating in the plan, and to exercise the neighborhood medical facilities. These drills have been combined with community forums and information campaigns in the neighborhood (and particularly Chinese language) media.

The group is working with the NERT program to develop Chinese language information materials (which has been funded) and NERT training sessions (which has not been funded). The organization is currently seeking funding resources for outreach to individual residents, coordination of volunteers, and coordination of drills, and the development of closer coordination between City emergency responders, the American Red Cross, and neighborhood groups.

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[38] The Salvation Army, *Central Kitchen Fact Sheet*, July 1992.

[39] Bob Moorehead, The Salvation Army, August 16 1993 telephone conversation.

[40] Lorraine Lowe, Asian Neighborhood Design, August 30, 1993 telephone conversation.

Pacific Gas & Electric has established two corporate Emergency Operating Centers to direct its efforts to restore gas and electric service after a disaster: one at its office in downtown San Francisco and an alternate in San Ramon.[41] Workers at the San Francisco Division's "storm center" will obtain an assessment of the extent of the impacts in the City, direct efforts to maintain service, protect property, restore services, restore critical functions, and restore other normal operating functions, allocate company personnel and other resources; provide information to the public, government agencies, the media, and company employees. A PG&E staff person will be stationed at the City's EOC to provide coordination with other response activities. PG&E augmented its computer and communications after the Loma Prieta earthquake in 1989. Periodic drills are held.

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[41] Pacific Gas and Electric, *Program for Reducing Earthquake Vulnerability of Gas and Electric Systems by the year 2000*, December 1990.

III. RECOVERY AND RECONSTRUCTION

A. Financial Assistance Programs

Most existing federal and state disaster recovery programs provide financial assistance in the form of grants or loans to individuals, businesses, non-profit organizations, and government agencies. These programs are intended to restore the physical facilities that existed before the disaster. They do not, as a general rule, fund or encourage replanning, enlarging or improving facilities unless the improvements are necessary to meet current codes.

Individual assistance programs.

Federal emergency recovery activities are authorized by the Stafford Act. The Federal Emergency Management Agency (FEMA) provides temporary housing assistance for households displaced from their homes. This program consists primarily of subsidies to be used in the private rental market. Even after the 1989 Loma Prieta earthquake and the 1991 East Bay Hills fire, where relatively small percentages of the regional housing stock were destroyed, the private rental market did not always have sufficient vacant units to provide adequate housing for those displaced. After the Loma Prieta earthquake, about 2,500 households received temporary housing assistance. Where private rental housing is not available, FEMA may provide temporary housing, such as mobile homes or other readily fabricated dwellings for disaster victims.[42]

Federal programs provide housing assistance, loans and grants to renters, owners, and businesses whose homes, buildings, or personal property were lost or damaged. A variety of agencies are involved. After the Loma Prieta earthquake, coordination between these agencies, and with State agencies involved in the administration of federal programs was not always smooth, leading to delays.[43] Multiple inspections were often required. Federal programs did not take into account higher costs of land, construction and housing in California. Inspectors did not recognize local costs and often under-estimated the costs of reconstruction. Federal loan programs administered by the Small Business Administration have a loan ceiling that may not provide for reconstruction (after Loma Prieta the ceiling for businesses, including multi-unit rental housing, was $500,000).

Federal programs do not include incentives to replace lost low-income housing units. As a result, while most of the housing units lost in the Marina district during Loma Prieta were rental units, almost all of the replacement units are condominiums.

State of California disaster assistance programs are generally designed to supplement existing federal programs when there is a Presidentially-declared disaster. For example, the California Disaster Assistance Program (CALDAP), the major State housing loan program, was available only to victims who had been turned down by federal programs. CALDAP does not have a ceiling on loan amounts, and includes incentives for maintaining affordability in replacement units.

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[42] FEMA has estimated that it costs approximately $36,000 per unit to move trailers to a site after an earthquake (including purchase, transportation and site preparation), reported in California OES and National Center for Earthquake Engineering Research, *Findings and Recommendations, Symposium on Policy Issues in the Provision of Post-Earthquake Shelter and Housing,* October 1992.

[43] Department of City Planning, *San Francisco's Loma Prieta Experience with an Emphasis on State Programs and Policies and their Implications for Local Recovery*, March 1991.

Public Assistance Programs

Public assistance programs are those that fund the repair and reconstruction of public facilities. These programs also assist non-profit agencies that provide public services. Applications are made through the California OES to FEMA. San Francisco's experience with these programs since 1989 has been that the application and appeal processes can be extremely detailed and time-consuming. As of June 1993, over three and one-half years after the Loma Prieta Earthquake, FEMA has approved about $100 million in repair costs. Approximately $200 million in costs are not resolved. Most of this $200 million relates to different interpretations of seismic code requirements. Public assistance programs also tended not to recognize the higher costs incurred in rebuilding in San Francisco compared to other places in the country.

Other State Recovery Programs

The State of California operated an earthquake insurance program beginning in July 1991. The program covered privately-owned single-family homes and individually-owned condominiums and mobile homes. It was financed by a surcharge on homeowners insurance policies averaging $36 annually, and would have had a much smaller deductible than private earthquake insurance. While mandatory, there were no penalties for not participating. In 1992 the state determined that the program would not collect sufficient money to cover possible losses and the program was discontinued.

Earthquake insurance is available through private insurance companies, who are required by State law to offer it to their residential customers. Typically, the deductible is 10% of the value of the home, and cost is about $1.50 to $2.00 per $1,000 of coverage.[44] Thirty to forty percent of Bay Area homeowners have earthquake insurance.[45]

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[44] California Department of Conservation, Division of Mines and Geology, *Seismic Hazard Information Needs of the Insurance Industry,, Local Governments, and Property Owners in California, Special Publication 108,* 1990.

[45] U.S. Geological Survey, *The Next Big Earthquake,* 1990.

The Community Redevelopment Financial Assistance and Disaster Project Law provides for the expedited designation of a redevelopment project area where there has been a Presidentially-declared disaster and a certification by the Governor that assistance is needed. The law is not specific about the kinds of redevelopment activities that can be undertaken in these redevelopment areas. Requirements for preliminary plans, public notice, and planning commission involvement are eased or eliminated. Relocation requirements are waived, but the legislative body must find that the plan encourages "to the maximum extent feasible . . . the provision of dwellings suitable for the needs of families displaced by the disaster or by redevelopment, rehabilitation or renewal activities."

B. San Francisco Recovery and Reconstruction Policies and Programs

Most local recovery policies and programs do not provide direct financial assistance to victims. Instead, they set the rules that govern rebuilding efforts, regardless of the financing used. There are no City ordinances or policies that are intended to guide reconstruction after a major earthquake. The current Community Safety Element of the Master Plan includes an objective and policies concerning recovery and reconstruction. They are discussed in Chapter 5.

Following are some City ordinances that apply generally to "calamity," or that were enacted specifically in response to the Loma Prieta earthquake. A larger earthquake could pose quite different issues.

San Francisco City Planning Code

Section 181(d) of the City Planning Code allows the reconstruction of buildings which do not conform to the current Planning Code, if they are destroyed by "fire, or other calamity, or by Act of God, or by the public enemy" and are rebuilt within one year. This provision, a common one in zoning ordinances, was enacted to ensure that owners whose buildings are destroyed by fire or in some other way not of their doing, are able to rebuild a similar building even if the regulations have changed since the structure was built. Such reconstructions must comply with the Building Code. There has not been a situation where there was widespread destruction from a single event and rebuilding under this City Planning Code provision.

Earthquake Emergency Permit Procedure.[46]

After the Loma Prieta earthquake, the Board of Supervisors adopted an emergency ordinance to expedite the repair or replacement of damaged residential buildings. This ordinance:

1. allowed owners of replacement buildings to seek authorization to increase the size of the new building above the size of the damaged building and above the size which would otherwise be permitted under the Planning Code if the increase could be attributed to Building Code requirements.

2. allowed owners of replacement buildings to seek exemptions from other City Planning Code provisions if, it could be attributed to Building Code requirements (for example the loss of a required parking space as a result of seismic strengthening).

3. gave previous tenants the right to reoccupy units which were repaired or rebuilt under the ordinance, and in some cases would have brought repaired or rebuilt units under the Rent Control ordinance which would otherwise not have been covered.

Permits issued pursuant to this ordinance had an streamlined public notice and review process. Ten owners were granted the larger size described in item 1 above, five owners were granted the reduced parking described in item 2 above.[47] (About 85 residential buildings were severely damaged or destroyed in the Loma Prieta earthquake.[48]) Most private residential buildings that were destroyed and rebuilt were rebuilt as condominiums in order to obtain financing. This may have contributed to owners' decisions not to avail themselves of this process.

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[46] City and County of San Francisco, Ordinance 414-89.

[47] Neil Hart, Department of City Planning, Earthquake repair plan checker, August 31, 1993 conversation.

All applications had to be submitted within one year of October 17, 1989. The Zoning Administrator could grant a two year extension. The procedure expired October 17, 1992.

Earthquake Damaged Illegal Units Legislation.

In 1990, Section 181(d) of the City Planning Code was amended to allow the restoration of previously existing housing units which had not existed legally before the earthquake.[49] This ordinance also refers specifically to the Loma Prieta earthquake. It allows the rebuilding of units with no established lawful existence, if it can be demonstrated that the unit was occupied within one year prior to October 17, 1989, and the unit can be brought into compliance with the Building Code, the Housing Code, the Fire Code, and State and Federal law. All such restored units must be offered to the previous tenant. If that tenant declines, they must be offered at the previous rent, or if the previous rent cannot be established at a rent affordable to households making 80% of the median San Francisco income. Four previously unrecorded residential units were rebuilt under this provision.[50]

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[48] Department of City Planning, *San Francisco's Loma Prieta Experience with an emphasis on State Programs and Policies and their Implications for Local Recovery*, March 1991.

[49] City and County of San Francisco, Ordinance 75-90.

[50] Neil Hart, Department of City Planning, Earthquake repair plan checker, August 31, 1993 conversation.

South of Market Redevelopment Project.[51]

The Community Redevelopment Financial Assistance and Disaster Project Law described above provides for redevelopment projects in areas impacted by natural disasters. Following the Loma Prieta Earthquake, the City adopted an emergency redevelopment area in the South of Market area, along the Sixth Street corridor. This area lost nearly 500 housing units in the earthquake, and contained many poorly-maintained, but vitally important buildings with low-income housing units.

The law provides little guidance about the kinds of activities that can be undertaken in these redevelopment areas. San Francisco officials have limited the application of the emergency redevelopment area to the individual properties within the area that sustained physical damage. Because City goals go beyond this constraint, the City plans to amend the area to make it a conventional redevelopment project.

A major goal of the redevelopment plan is to replace the housing that was lost and to develop new housing. About 500 new family and small size units, and 500 new single room occupancy hotel units are planned; about 250 family and 800 SRO units will be rehabilitated. Many of these units will by owned and operated by a new local non-profit management corporation. The redevelopment program includes the a business development loan program, public improvements, and technical assistance to area residents and businesses to prepare for future earthquakes. As of August 1993, 194 residential units are under construction.

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[51] San Francisco Redevelopment Agency, *Redevelopment Programs '92-'93, Summary of Project Data and Key Elements.*

C. Other

There is a recognition among those concerned with the impacts of disasters and those concerned about housing issues that no programs now exist that are capable of replacing the housing, especially low-cost housing that will be destroyed in a large urban California earthquake. The Seismic Safety Commission has identified this issue in *California at Risk, Reducing Earthquake Hazards 1992-1996,* with Initiative 4.5, Provide Post-Earthquake Housing. The initiative recommends a combination of current mitigation programs and post-disaster replacement programs.

These issues were raised and discussed at a symposium on earthquake and housing issues attended by staff of government agencies, earthquake professionals and housing experts.[52] They concluded (among other things) that:

- Post-earthquake housing policy is related to pre-earthquake housing policy
- Avoidance of temporary housing is a worthy goal.
- Housing reconstruction should be tied to employment
- Population and housing stock vulnerability should be reduced prior to an earthquake.
- Earthquake housing needs can exacerbate existing problems or be an opportunity for growth.
- Financing of low-income housing recovery is a particular problem.
- The provision of post-earthquake housing should be coordinated.
- Local residents and government need to be involved in all stages of planning the recovery.
- The role of the historic preservation community should be clarified.

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[52] Bay Area Regional Earthquake Preparedness Project, Governor's Office of Emergency Services; National Center for Earthquake Engineering Research, State University of New York at Buffalo, *Findings and Recommendations, Symposium on Policy Issues in the Provision of Post-Earthquake Shelter and Housing,* October 1992.

Safety Elements in other jurisdictions have included recovery policies. The Los Angeles County *Safety Element* recommends the establishment of a "Los Angeles County Reconstruction Authority" and includes a draft ordinance.[53] The Authority would be created before a disaster, and would begin establishing procedures for the post-disaster phase as soon as it was formed. Its charge would be "to facilitate reconstruction of structures and facilities destroyed or damaged during a major earthquake; provide special procedures to expedite public and private recovery activities; guard against reconstruction which could result in future peril to life or property; encourage the improvement of the environment where new opportunities have been created by severe property damage and enable the County of Los Angeles to cooperate more effectively with other local jurisdictions, and agencies of the State and the Federal governments during reconstruction."

The City of Los Angeles is developing a Recovery and Reconstruction Plan. The plan "will provide the policy direction and operational guidance for City departments to plan and manage recovery and reconstruction from any severe natural disaster."[54] A draft is being considered which addresses:[55]

* Residential, Commercial and Industrial Rehabilitation
* Public Sector Services
* Economic Recovery
* Land Use/Re-Use
* Organization and Authority
* Psychological Rehabilitation
* Vital Records
* Interjurisdictional Relationships

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[53] County of Los Angeles Department of Regional Planning, *Los Angeles County General Plan Safety Element,*and Technical Appendix, adopted December 1990.

[54] Kenneth C. Topping, AICP, *Report on Recovery and Reconstruction Plan Revisions, City of Los Angeles,* May 1, 1992.

[55] City of Los Angeles, *Recovery and Reconstruction Plan,* Draft May 1992, included in Kenneth Topping, AICP, *Report on Recovery and Reconstruction Plan Revisions, City of Los Angeles,* May 1992.

Policies are included for each of these functions, along with action programs to implement the policies. Responsible city departments are identified. Pre-event actions, such as the preparation of ordinances which can take effect when a local emergency is declared, are described.

Cities which have experienced large earthquakes have not usually had plans, procedures or responsibilities in place to guide reconstruction. Santa Cruz was among the areas most impacted by the Loma Prieta earthquake. Santa Cruz officials and citizens created a process which lead to the *City of Santa Cruz Downtown Recovery Plan*[56] The Plan evolved out of a 15-month, 250-meeting process beginning with the establishment of a non-profit corporation, "Vision Santa Cruz." Vision Santa Cruz developed a set of generally-accepted "First Principles," on which the plan was based. The plan establishes policies, standards and guidelines that will direct the recovery process. It includes both short-term and long-term recommendations. It includes a land use plan that considers the potential for and economic viability of retail, housing and office uses; area by area development standards and design guidelines; a detailed streetscape plan for Pacific Avenue; circulation and parking; and streets and open space.[57]

Santa Cruz County passed a six-year, one-half cent sales tax to help fund recovery efforts, both public and private. All major private reconstruction projects included some level of public financial participation, from federal, state or county disaster assistance. Santa Cruz used redevelopment powers granted by special State legislation which (among other things) allowed a shortening of otherwise required processes (including exempting the project from the California Environmental Quality Act) and adjusted the base value of the property for the purposes of calculating the tax increment.

Charles Eadie, project manager for the Santa Cruz Downtown Recovery Plan, observed: "Rebuilding following the earthquake is an invitation to struggle. Great care must be taken to create processes and structures that bring the key participants to the table and effectively inform, educate and engage the public. Urban design issues are emotional and require patience, information and iterative processes to work through. There are no shortcuts."[58]

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[56] ROMA Design Group for the City of Santa Cruz, *City of Santa Cruz Downtown Recovery Plan*, Draft March 1991.

[57] Charles Eadie, Project Manager, Downtown Recovery Plan, Santa Cruz, Telephone Conversation August 27, 1993.

Recognizing that it is often difficult for local jurisdictions to spend time and resources on recovery planning before a disaster, the California OES Earthquake Program (formerly BAREPP) is preparing *Earthquake Recovery; A Survival Manual for Local Governments*, working with staff of local agencies, many of whom have experienced disasters first-hand.[59] A draft was completed in early 1993, and a final is expected by the end of 1993. It will include chapters on

- Recovery Management and Financing
- Rebuilding and Reconstruction
- Housing Recovery
- Recovery of Public Facilities and Services,
- Business Recovery

Each chapter will identify key issues, list relevant federal and state laws and regulations, and provide "hints" from communities which have faced these issues in the past. It will also include examples of documents developed by local governments during and after disasters that could be used as models, such as ordinances, public information releases, and procedural checklists.

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[58] Charles Eadie, *Recovery and Reconstruction: Architecture and Urban Design.*

[59] Paula Schulz, California Office of Emergency Services Earthquake Program, August 23, 1993 Telephone conversation.

IV. COMPREHENSIVE EARTHQUAKE POLICY EFFORTS

A. Federal Policies and Programs

National Earthquake Hazards Reduction Program.

In 1977, the U.S. Congress passed the Earthquake Hazards Reduction Act creating the National Earthquake Hazards Reduction Program (NEHRP). This program allocates funds for earthquake related research and preparedness projects. It is coordinated by the Federal Emergency Management Agency. NEHRP's six major objectives are:

- Coordinate federal agency programs.
- Maintain comprehensive research and development activities for hazard mitigation and earthquake prediction.
- Further develop, through the Federal Interagency Committee on Seismic Safety in Construction, standards for federal projects.
- Develop federal earthquake response plans and help state and local jurisdictions to develop and improve theirs
- Analyze how finance and monetary systems/institutions could function after either a credible prediction or real event and how they could foster hazard reduction.
- Examine the insurance industry's mitigation role.

NEHRP has funded basic research in geology and seismology undertaken by the U.S. Geological Survey, and other earthquake-related research through the National Science Foundation. Local earthquake programs funded through NEHRP include the California OES Earthquake Program.

B. State and Regional Policies and Programs

California Earthquake Hazards Reduction Act of 1986.

This act is administered by the California Seismic Safety Commission. It is intended to identify the hazards from earthquakes and determine ways to reduce their effects through hazards reductions, enhanced emergency response, and improved recovery capabilities. The Commission (in conjunction with other State agencies) is charged with preparing a five year plan, updated annually, to achieve these goals. The most recent five year plan, *California at Risk, Reducing Earthquake Hazards 1992-1996*, was released in December 1991. It has been referenced throughout this report. It is a compilation of 42 "Initiatives" to be undertaken by state or local agencies. The Initiatives are organized into six categories: Existing development, Emergency planning and response, Future development, Recovery, Education and public information, and Research. Milestones to track the progress of the initiatives are included. The Seismic Safety Commission staff has been reduced from thirteen to seven people, due to a reduction in funding. This has reduced its ability to track and facilitate progress on the Initiatives, or to produce annual updates.[60]

California Office of Emergency Services.

The California Office of Emergency Services has the primary state-level responsibility for emergency response activities, as described in Chapter 2. It also has an Earthquake Program (formerly called the Bay Area Regional Earthquake Preparedness Project) which conducts research and provides technical assistance to local governments, other organizations, and the public on many earthquake-related issues.

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[60] Fred Turner, California Seismic Safety Commission, Telephone conversation, August 19, 1992.

Association of Bay Area Governments.

The Association of Bay Area Governments (ABAG) is an active participant in regional earthquake preparedness activities. It maintains a geological database with mapping capabilities which has been used to provide detailed maps of earthquake hazards. It has conducted studies of the ground shaking hazard throughout the region, of the impact of earthquakes on the region's building stock, of the macroeconomic impact of the Loma Prieta earthquake. (These studies are summarized in *Background Report #1*.) ABAG is currently developing estimates of the numbers of people likely to need short-term housing as a result of an earthquake.

IMPLEMENTATION OF THE CURRENT COMMUNITY SAFETY ELEMENT

The State of California requires each city and each county to adopt a "comprehensive, long-term general plan". There are several elements which must be included in the general plan. One of these is the safety element "for the protection of the community from any unreasonable risks associated with the effect of seismically induced surface rupture, ground shaking, ground failure, tsunami, seiche, and dam failure; slope instability leading to mudslides and landslides; subsidence and other geological hazards . . .; flooding; and wild land and urban fires."[61]

San Francisco's safety element, called the Community Safety Element, was adopted by the City Planning Commission on September 12, 1974.[62] In 1974, state law required both a seismic safety element addressing seismic hazards, and a safety element addressing other safety concerns. San Francisco, and other counties, chose to combine these two elements, and the state law has been changed to encourage local governments to produce one element covering all natural environmental hazards and their secondary impacts.

The Community Safety Element, like all elements of the San Francisco Master Plan, is produced by the City Planning Department and adopted by the City Planning Commission, as provided in the City's Charter. Once adopted, elements are transmitted to the Board of Supervisors and other decision-makers with responsibilities for determining and carrying out City policy. Achieving the greatest possible preparedness for earthquakes and other natural disasters requires the participation and cooperation of many City departments and agencies, as well as regional, state and federal agencies.

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[61] Government Code Section 65302

[62] City Planning Commission Resolution 7241, September 12, 1974.

Background Studies

Several background studies preceded the adoption of the 1974 Community Safety Element. They will be described here, and their conclusions summarized. Many of the Element's objectives and policies resulted from the background studies. Discussion of the progress towards implementing any recommendations is in the following section, organized by objective.

The most ambitious background study was the *San Francisco Seismic Safety Investigation*, usually referred to as the Blume Report, prepared by the engineering firm John A. Blume & Associates in June 1974. It contains both geologic and structural evaluations. Basic geologic data were compiled from published and unpublished investigations performed by government agencies, private firms, and individuals. Maps showing San Francisco geology, fault locations, estimated ground shaking intensity, landslide locations, liquefaction hazard, tsunami potential, reservoir failure inundation areas, and subsidence potential are included. Smaller-scale reproductions of these maps are included in the Community Safety Element. The study also provided an assessment of structural hazards, including estimates of potential building damage, of at-risk building types, of potential damage to lifelines and emergency services, and recommendations for reducing hazards. It describes (in more general terms than more recent studies have) the hazards resulting from unreinforced masonry buildings and the distribution of those buildings throughout the City.

The Blume report includes the following recommendations for future action. The report states "The geologic hazard maps should be modified as new information is acquired or published." Although much geological research has been undertaken since 1974 by government agencies, and by private firms investigating land in preparation for development, the geologic hazard maps in the Community Safety Element have not been revised. The report recommends that the San Francisco Building Code be periodically reexamined as new information is available and new design criteria are found to be useful, reliable and acceptable. This contributed to Objective 1, Policy 6 of the Element: "Review and amend at regular intervals all relevant public codes to incorporate the most current knowledge and highest standards of seismic design."

It recommends that the City encourage the demolition or the reinforcement of unreinforced masonry buildings and other potentially hazardous buildings. The report also recommends that typical two- or three story residential buildings with little resistance in the transverse direction of the lower story ("soft stories") be reinforced. This contributed to Objective 1, Policy 2: "Initiate orderly abatement of hazards from existing buildings and structures."

Finally, the Blume report suggested that "this type of study should be repeated after a period of about 10 years to account for the changes in San Francisco's buildings, new technology and state-of-the-art, any intervening earthquakes, and to compare San Francisco's earthquake potential at that time with its present potential."

In early 1974, the Department of City Planning produced five background reports in preparation for the Community Safety Element. The first was *Strong-Motion Instrumentation.* This paper recognized that there was little understanding about the "complex ways in which the earth moves", that strong-motion instrumentation programs being undertaken by the federal and state governments could advance our knowledge about earthquakes and about effective ways of mitigating hazards through structural design and other means, and that by encouraging local participation in these programs, city policy could contribute to these efforts. Strong-motion instruments are a type of seismograph, modified to measure only the stronger vibrations generated by local earthquakes, which monitor the motion generated by an earthquake and its effect on various structures and geologic environments. An effective research program requires that instruments be installed in a wide variety of locations. In 1974, forty instruments had already been installed in San Francisco. This paper resulted in a policy of the Community Safety Element to "Support seismic research through appropriate actions by all public agencies". (Objective 1, policy 7)

The second background report was *San Francisco Parapet Ordinance.* The life safety hazards presented by parapets and decorative ornamentation shaking loose during an earthquake and falling on passing pedestrians or through the roofs of adjacent buildings had been recognized by the parapet ordinance, adopted in 1969. The parapet ordinance is part of the San Francisco Building Code, and assigns to the Bureau of Building Inspection the responsibility for correction of every "parapet and appendage which would be a hazard to life or limb". Due to a lack of funding and inspection personnel, the ordinance was not enforced between 1969 and 1974. The background report described the progress of parapet mitigation efforts, and described the controversies surrounding the issue, particularly the concern that parapet hazards would be mitigated in ways which would detract from buildings' appearance or historical character. It recommended Department and Commission review of parapet alterations, and the consideration of legislative actions after a period of study. This paper resulted in policies of the Community Safety Element to "Initiate orderly abatement of hazards from existing buildings and structures", (Objective 1, policy 2) and "Preserve the architectural design character of buildings and structures subject to requirements for abatements of hazards to life safety", (Objective 2, policy 1)

The third background report was *Post-Disaster Financial Assistance.* It describes the major governmental funding sources which would have been available for recovery and reconstruction after a major disaster in 1974, and makes recommendations for recovery and reconstruction City policy. Much of the information in this paper is obsolete. Some of this information contributed to Objective 4 -- Reconstruction: "Assure the sound and rational reconstruction of San Francisco following a major disaster."

The fourth background report was *Emergency Operations Center.* It describes City efforts to establish a new Emergency Operations Center (EOC). In 1974 the EOC was located at the Youth Guidance Center on Woodside Avenue near Twin Peaks. It was considered inadequate. The background report describes the search for a new site for the construction of an up-to-date EOC, proposals that had been made, and the difficulty of securing funding. It also puts forth the concept, which has since been adopted by the City, that in place of an EOC, an Emergency Coordination Center (ECC) could link the City's departmental emergency systems. This paper resulted in a policy of the Community Safety Element to "Establish and maintain an adequate Emergency Operations Center", (Objective 3, policy 4).

The fifth background report was *Emergency Operations Plan.* It describes the governmental response structure for a disaster. In 1974, as now, the responsibility for the preparation, coordination and implementation of San Francisco emergency response plans and activities was the Office of Emergency Services, which is part of the Mayor's Office. The report recommended that the S.F. Office of Emergency Services staff be increased and vacancies filled to increase its effectiveness, that emergency plans be prepared and evaluated, that a comprehensive public education program by undertaken, that a site for an emergency operations center be selected and construction funding sought. This paper resulted in policies of the Community Safety Element to "Maintain a local agency for the provision of emergency services to meet the needs of San Francisco", (Objective 3, policy 1) and "Develop and maintain viable, up-to-date in-house emergency operations plans, with necessary equipment, for operational capability of all emergency services agencies and departments", (Objective 3, policy 2) "Provide continuing public educations regarding emergency procedures", (Objective 3, policy 7).

The Element

The Community Safety Element, adopted in 1974, contains four objectives and 18 policies. There is a discussion under each policy which describes, briefly, the reasons for the policy and, in very general terms, how it should be implemented. Following is a discussion, by objective, of the current status of actions which have been taken to implement the Community Safety Element. Where programs have been undertaken, they are more fully described in Chapters 1, 2, and 3 of this report.

Objective 1 – Life Safety: Reduce hazards to life safety, minimize property damage and economic dislocations resulting from future earthquakes.

Policy 1: Apply a minimum level of acceptable risk to structures and uses of land based upon the nature of the use, importance of the use to public safety and welfare, and density of occupancy.
Policy 2: Initiate orderly abatement of hazards from existing buildings and structures.
Policy 3: Abate existing hazards in all critical community facilities; where it is not feasible to abate hazards to existing facilities in special geologic study areas, move them to new safer locations; limit location of new facilities to sites outside special geologic study areas unless no viable alternative exists.
Policy 4: Require geologic or soil engineering site investigation, and compensating structural design based on findings, for all structures in special geologic study areas.
Policy 5: Modify permitted land uses and types of structures, where appropriate, according to geologic factors and consistent with the levels of acceptable risk.
Policy 6: Review and amend at regular intervals all relevant public codes to incorporate the most current knowledge and highest standards of seismic design.
Policy 7: Support seismic research through appropriate actions by all public agencies.

Actions which have been taken to implement Objective 1 have generally involved the regulation of new construction, and to a lesser extent, the abatement of hazards in existing private buildings. Building Codes have been regularly updated as the structural engineering profession has steadily gained more knowledge about how buildings can be made safer during earthquakes. This process is described in Chapter 1.

As recommended by Policy 4, the Bureau of Building Inspection considers site-specific soils conditions when reviewing building permits. This process is described in Chapter 1.

However, these new structural standards apply only to new construction, or to buildings undergoing a substantial enlargement or a change in use. Some older buildings and structures pose a hazard in an earthquake. The City's parapet ordinance, the subject of one of the 1974 background papers, is being enforced, and this hazard is being abated. The City has begun a program to reduce hazards in unreinforced masonry buildings, a category of building identified in the Blume report as hazardous. These programs are described in Chapter 1. No program to address the problem of soft-story buildings has been undertaken.

City Planning Code amendments and rezonings enacted since 1974 have increasingly been undertaken with a consciousness of geologic risk factors. For example, while the Mission Bay Plan was being considered, studies of soils conditions and earthquake risk were conducted because the area is underlain by the kinds of soils and unengineered fill known to be susceptible to ground failure.[63] These studies assessed the risks to future buildings, utilities and transportation systems. They evaluated the kinds of foundations necessary and the implications of the types of development that would be feasible. These studies resulted in specific plan features, including multiple access points in case of a bridge or overpass failure, locating of fire and police stations in the plan area, flexible underground utility systems, and a neighborhood-based emergency response plan which will include planning for likely loss of utilities.

Changing zoning regulations (and changing building standards) do not directly address existing hazards in existing buildings, because these buildings may remain even if not in conformity with new zoning or new codes. It is even possible that zoning regulations which are intended to maintain the existing scale and character of areas (which includes many San Francisco zoning amendments since 1974) may encourage the retention of hazardous buildings. Hazard mitigation programs such as the parapet ordinance and the unreinforced masonry building program are especially important when planning policies encourage the retention of existing buildings.

As part of the *Earthquake Safety Program*, the City has undertaken a survey of potentially vulnerable City-owned buildings, including those containing essential facilities. Voter-passed bonds are funding the retrofit of many of these buildings. This program is described in Chapter 1.

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[63] EQE Engineers, *Seismic Safety Special Study*, 1986. Dames & Moore, Daniel Solomon & Associates, Shapiro, Okino, Hom & Associates, EDAW, Inc, Williams & Burrows, Ray Lindahl, And EQE engineers, *Soils Conditions, Mission Bay San Francisco*, 1986.

San Francisco has conducted considerable research on the social and economic implications of earthquakes and seismic policies. The unreinforced masonry building program resulted in a number of reports describing possible programs, their engineering and life safety implications, eir financial and social costs.[64]

Objective 2 – Preservation: Preserve, consistent with life safety considerations, the architectural character of buildings and structures important to the unique visual image of San Francisco

> Policy 1: Retain the architectural design character of buildings and structures subject to requirements for abatement of hazards to life safety

There have been two major hazard abatement programs since 1974, the Parapet ordinance and the Unreinforced Masonry Building (UMB) program. The Parapet ordinance was enacted in 1969, and its enforcement was postponed for some time, for lack of funding as well as a concern that owners would remove visually important parapets, or strengthen them in an insensitive way. These programs are described in Chapter 1.

The studies done for the Unreinforced Masonry Building Hazard Reduction Program have included the identification of buildings which would be subject to the program which have historic value. A survey of all UMBs, which evaluated them for their architectural and historic value was conducted.[65] The EIR assessed the likelihood that the program alternatives would result in the loss of historic resources. Because many San Francisco UMBs have historic value, it is likely that some historic resources will be lost as the program proceeds. These losses were considered by the decision-makers during their deliberations on the program. The EIR also showed that, in the absence of retrofit, more historic buildings will be lost as a result of earthquake damage. As part of the UMB program, the City Planning Commission adopted a set of design guidelines to encourage retrofitting techniques that are sensitive to the historic fabric.[66]

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[64] Comerio, Mary, Center for Environmental Changes, *Earthquake Hazards and Housing*,1987. Recht Hausrath and Associates, *Seismic Retrofitting Alternatives for San Francisco's Unreinforced Masonry Buildings, Socioeconomic and Land Use Implications of Alternative Requirements*, October 1990. San Francisco Department of City Planning, *Earthquake Hazard Reduction in Unreinforced Masonry Buildings: Program Alternatives, Final Environmental Impact Report*, July 1991.

[65] Landmark Preservation Advisory Board, San Francisco of City Planning, *A context Statement and Architectural/Historical Survey of Unreinforced Masonry Building Constructions in San Francisco from 1850 to 1940*, November 1990.

Objective 3 – Emergency Operations: Ensure the protection of life and property from the effects of fire or natural disaster through adequate emergency operations preparation.

Policy 1: Maintain a local agency for the provision of emergency services to meet the needs of San Francisco.
Policy 2: Develop and maintain viable, up-to-date departmental emergency operations plans, with necessary equipment, for operational capability of all emergency service agencies and departments
Policy 3: Maintain and expand agreements for emergency assistance from other jurisdictions to ensure adequate aid in time of need.
Policy 4: Establish and maintain an adequate emergency operations center.
Policy 5: Maintain and expand the City's fire-prevention and fire-fighting capability.
Policy 6: Establish a system of emergency access routes for both emergency operations and evacuation needs.
Policy 7: Provide continuing public education regarding emergency procedures.

Responding to emergencies in San Francisco is the responsibility of several City departments. Under normal circumstances (in the absence of a major disaster requiring a concerted inter-departmental response) these departments act with considerable autonomy. The Fire Department is responsible for fire suppression, search and rescue, and first aid under some circumstances. The Police and Sheriff Departments are responsible for law enforcement. The Department of Public Health operates ambulances and emergency medical facilities, and responds to emergencies involving toxic materials. These programs are described in Chapter 2.

A major earthquake, or other disaster, requires extraordinary response levels and cooperation between departments. The Office of Emergency Services (OES), which is within the Mayor's Office, is charged with planning how this cooperation will occur, preparing the City's Emergency

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[66] American Institute of Architects San Francisco Chapter, Preservation Committee, *Architectural Design Guide for Exterior Treatments of Unreinforced Masonry Buildings during Seismic Retrofit*, November 1991.

Operations Plan (EOP), and with otherwise preparing the City for a major disaster. According to the background study, in 1974 there was a staff of seven in OES, plus six liaison staff from Police the Fire Departments. There are currently three full-time professional staff people in the OES. The OES is described in Chapter 2.

The City's current Emergency Operations Plan was completed by OES in 1987.[67] It contains "annexes" which were prepared by individual departments and serve as departmental emergency plans. A new EOP is currently being drafted by an inter-departmental task force coordinated by the OES, which currently has a staff of three. This project is described in Chapter 2.

The major responding departments, including the Police Department, the Fire Department, the Department of Public Works, the Department of Public Health, maintain their own operations centers after an emergency, which they equip according to their needs. The necessary inter-departmental coordination will occur at the Emergency Coordinating Center (ECC). A new ECC was built at 1003A Turk.

In accordance with Policy 3, the City is a participant in the State Master Mutual Aid agreement, which facilitate the sharing of emergency assistance from other jurisdictions. It is described in Chapter 2.

The Fire Department's Neighborhood Earthquake Response Training (NERT), which provides public education regarding emergency response, is described in Chapter 2.

No emergency routes have been designated. However, the current re-examination of the Emergency Operations Plan is likely to consider the issue of designating emergency routes.

Objective 4 -- Reconstruction: Assure the sound and rational reconstruction of San Francisco following a major disaster.

> Policy 1: Maintain the sound and rational redevelopment of San Francisco, following a major disaster, by rebuilding in accordance with established Master Plan objectives and policies, appropriate City codes, and other community concerns and needs.

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[67] San Francisco Office of Emergency Services, *Emergency Operations Plan*, 1987.

Policy 2: Adopt contingency legislation to provide for anticipated needs following a disaster and to reduce pressures for unnecessarily rapid reconstruction.
Policy 3: Create a Reconstruction Planning Committee to insure that development takes place in a timely fashion according to established objectives and policies.

No contingency legislation has been adopted, and no committee has been formed to consider reconstruction issues.

The rebuilding that has occurred has generally been in accordance with established Master Plan objectives and policies, current City codes (recognizing that some damaged and destroyed buildings had been legally non-conforming). An earthquake permit process, with provision for community input was established and is described in chapter 3.

Conclusion

Some of the Objectives and Policies of the 1974 Community Safety Element represent ongoing goals such as "reducing hazards" or "protecting life and property." Although programs have been undertaken to mitigate existing hazards, additional hazardous conditions remain to be addressed. The provision of emergency services is a basic public service subject to the same resource and management constraints of all public services. While these objectives will remain in some form, the programs required to attain them should be scheduled and implemented to continue progress.

Objective 3 restates a continuing value of San Francisco, a concern for the historic fabric, which have been and will be seriously considered during future consideration of programs that influence land use or building use.

Objective 4, concerning the reconstruction of San Francisco following a major disaster, has received the least attention since 1974. This experience is similar to that of other jurisdictions. It is difficult for the public and for government to focus on, plan for, and devote resources to, an event that may occur tomorrow, or in several years. The update of the Community Safety Element will be an opportunity for the public and decision-makers to confront this issue.

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